Annual Report
For the Period Ending 30 June 1992

Continuation of Signal Detection Using Polyspectra
Contract N00014-91-J-1276

Published Paper

An invited paper co-authored with Jack Sheehan entitled "Ocean Acoustic Field Matching: Normal Mode Filtering and Non-Gaussian Sources," was published in the July 1993 issue of the IEEE Journal of Oceanic Engineering (Vol. 18, No. 3). This paper provides a theoretical foundation for the experimental findings that the acoustic field radiated from a large submerged object is a non-Gaussian random process. We develop a link between normal mode filtering and statistical field matching which is new and potentially important for underwater sound analysis. The results can be applied to other forms of acoustic radiation.

Technical Reports Accepted for Publication

A.   A technical paper entitled "Trispectral Analysis of Stationary Random Time Series" (with J. Dalle Molle) has been revised for publication in the Journal of the Acoustical Society of America. This paper exhibits trispectral analysis of acoustic signals of ships measured by sonobouys.

B.   A paper entitled "Cumulants and Cumulant Spectra" is forthcoming in a special issue of *Circuits, Systems, and Signal Processing* edited by Dr. Ed Sullivan (NSWC, Newport) and myself. This special issue presents a number of new papers on higher order spectra. In addition to the review paper cited above, the issue will contain a paper co-authored with Lt. Colonel Richard Barker (USAF) and Professor Klutke (UT Austin) on the application of the bispectrum and the second order cumulant spectrum to diagnose drill wear.

Technical Report

A paper has been written on a new test for detecting third, as well as second order correlation, in a random signal. A FORTRAN program to compute the statistics has also been written. The program breaks a data record into a set of windows whose length is determined by the user and then computes the statistics for each window. This allows the user to analyze a large data set which may be nonstationary.
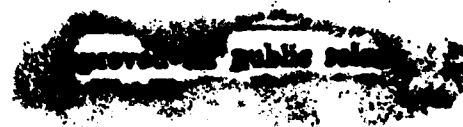
New FORTRAN Programs

The bispectrum code as been completely re-written so that a bandwidth can be specified by the user. The new code is considerably simpler than the code written with Dalle Molle. The new code also includes a calculation of the second order cumulant spectrum, which is important for the analysis of cyclostationary and non-ergodic signals.

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